Comments on Draft DEIS/R
for Marin 101 Gap Closure Project

July 31, 1997

For the record, I am submitting the following as a private citizen and not as the Chairman of the Citizen's Advisory Group for Caltrans. The following comments and questions are being raised because they were either not included, addressed or adequately answered in either the DEIS/R or the technical reports for the Marin 101 Gap Closure Project. Please respond to these comments and questions in the Final EIS/R.

Section 6.15.5. of the DEIS/R states: "There are, however, special situations where reflections could be a problem. These situations involve single barriers in certain types of geometrics, parallel barriers in certain configurations and noise barrier/structure interactions, "

COMMENT: The DEIS/R and the Noise Report both fail to illustrate or describe in detail these "special situations" or "noise sensitive areas" (such as the homes on the hillsides over-looking the freeway) for the 101 HOV Gap Closure Project. They also fail to calculate the maximum noise reflections or multiple noise reflection impacts possible as result of the different alternatives -- including the no-build alternative.

Section 6.15.5. states: "If potential reflection problems are identified, noise absorptive materials or other options may be considered."

COMMENTS: Since the parallel sound walls were built along the 101 Freeway through San Rafael in the mid 1980's, there have been numerous complaints regarding increases in noise from the homeowners on the hillsides overlooking the freeway. Caltrans assured the City of San Rafael that they would do noise studies along the corridor after the walls were completed. To date, no test have been conducted or calculations modelled to study the reflected noise or multiple reflections from the San Rafael sound walls. Since the current 101 HOV Gap Closure Project will incorporate or reconfigure some of those noise barriers, the following questions are relevant and deserve an answer.

At what point in the construction of Section 3 of the current 101 Gap Closure Project, will potential reflection and multiple reflection problems be addressed, tested for or identified, (1) how will they be mitigated, (2) how will the mitigation be funded and (3) what "other options may be considered?"

COMMENT: The DEIS/R fails to mention that the Noise Impact Report identifies a potential reflective problem, for a hundred foot section of wall in the Southbound Alternative (near Linden Lane), but chooses to do nothing as an option. The Noise Report fails to adequately calculate the potential noise impacts from this section of wall or list all options available (i.e. green walls, living walls, absorptive walls or

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building the walls on an angle).

The DEIS/R and the Noise Report are out-of-date in regard to material and building costs for absorptive walls and other alternatives. Currently, nationwide, absorptive walls prices are competitive with concrete block barriers. Only when absorptive material is used for retrofit does the price double the cost of a noise barrier. If Caltrans hasn't tested and approved the absorptive walls, which has been done in other states, they could use the 101 HOV Gap Closure Project as a demonstration project.

Section 6.15.5. states: "The degrading effects on the barriers performance due to the presence of a parallel reflective noise barrier on the opposite side of a roadway have been studied extensively since the 1970's. Although experts agree that the degrading effects are caused by multiple reflections between the two barriers, there are conflicting opinions on the magnitude of the problem."

The DEIS/R and the Noise Report fail to identify the "conflicting opinions" and the possible or theoretical "magnitude of the problem?" The reports fail to calculate a "worst case scenario" for reflected noise or multiple reflections on this project? They also fail to mention that the sound walls may "change" the frequency of the traffic noise which may cause a perceived increase in noise.

Section 6.15.5. states: "On this issue, Caltrans has done two detailed studies, one along 1-405 in Los Angeles (Caltrans, 1989), and another along Route 99 in Sacramento (Caltrans, 1991). These studies dealt with the acoustical performances of parallel barriers and the possibility of noise reflection problems."

COMMENT: The DEIS/R fails to mention that the "1-405 in Los Angeles (Caltrans, 1989) Report" states on page 26, under the heading "RECOMMENDATIONS," that "Due to the complex geometry of the project site, the results of this study should be considered specific to this site only. They should not be applied to other parallel sites."

Why was the "1-405 Report" referred to in the DEIS/R and the Noise Report if it "should be considered specific to this site ONLY" and "should NOT be applied to other parallel sites?"

The Noise Report identifies, that according to the "Route 99 in Sacramento (Caltrans, 1991) Report," that there should be at least a ratio of 10:1 between the height of the noise barriers and the distance between them (parallel 12 foot walls should be separated by at least 120 feet) or there might be serious problems of reflected noise and/or multiple reflections for homes above the freeway. (This W/H 10: **1 ratio formula was originally taken from a FHWA study.) In Sacramento there is a (W/H) ratio of 15: 1 while in San Rafael the ratio is approximately 8: 1. In other words, the Sacramento walls are almost double the distance as the walls through San Rafael.**

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However, both the DEIS/R and the Noise Report failed to identify that the existing noise barriers in San Rafael are at a ratio of approximately 8:1 and may be impacting the present homeowners who live above the freeway. Since the San Rafael parallel walls are clearly closer than 10:1 and one of the alternatives is a "NoBuild Alternative," the impacts from possible noise reflections and multiple reflections needs to be identified, calculated and mitigation considered. Also, the DEIS/R does not include a map showing existing noise barriers.

Since Caltrans' "Route 99 Report" states that: "Construction of a noise barrier between source and receiver tend to enhance wind effects," the DEIS/R and the Noise Report are inadequate because they fail to identify the possible noise impacts due to enhanced or cumlative wind effects and atmospheric conditions for the various alternatives within the project boundaries. The Reports also fail to identify and calculate the changes the enhanced wind effects may have on perceived traffic noise due to the removal of large trees, which presently act as a wind break, along the west side of the freeway.

DEIS/R and the Noise Report failed to identify two areas which may be impacted by noise because of overlapping or parallel noise barriers.

The first problem area is the the proposed walls identified in the Noise Report as S457. These walls are in two segments allowing for a bicycle path to cross between them. According to a highway noise expert I consulted, by leaving an opening between the walls, it may render the walls ineffective and may, in fact, cause multiple reflections between the overlapping walls, which would increase significantly the noise directly behind the opening.

The second problem area is located at the Lincoln Avenue Exit where three noise barriers (S633, S655 and S661) are proposed. According to a noise expert, the overlapping walls (at a H/W ratio of maybe 2: 1) could cause multiple reflections which, in turn, could actually increase the noise levels behind the walls.

DEIS/R and the Noise Report failed to identify the two separate noise sources impacting Receptors 22 and 22A. One source is coming from the top of the elevated road bed AND another from underneath the overpass road bed. Standing under the overpass it is very clear that a significant amount of noise is being transmitted through and between the roadbed. If the proposed barrier is built without addressing the noise problem coming from underneath the freeway, it could degrade the effectiveness of the proposed barrier and increase the Noise Pollution Level for those residents.

The DEIS/R and the Noise Report also failed to study or identify the homeowners, overlooking the freeway, who may have a significant increase in perceived noise simply because they will be able to see the relocated noise barriers on the opposite side of the freeway, after the freeway is widened. The traffic noise could be blocked but not the reflected noise with the result that the reflected noise would control the receiver. Calculations and traffic modelling show that noise reflections and multiple

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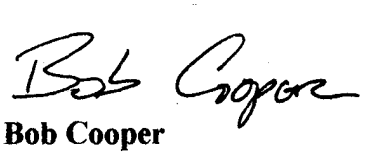
reflections can increase noise levels by more than 6dBA.

Also the DEIS/R, the Noise Report and the Socio-economic Report fail to identify how the property values have been and/or will be adversely impacted by the reflected noise and/or multiple reflections in combination with the wind effects as a result of the different alternatives.

The DEIS/R fails to mention Caltrans' "CALILFORNIA NOISE BARRIERS JUNE 1992" Report, in which it stated, on page 80, the following: "The question of reflected noise needs to be resolved. If it were true that neighborhood noise levels were actually increasing as a result of constructing new barriers, then the whole idea behind constructing barriers as a method of noise mitigation would appear to be flawed."

SUMMARY: Federal Guidelines have calculated and warned against reflections and multiple reflections caused by noise barriers for over 25 years. They have recognized these flaws and recommended mitigation. The DEIS/R and the Noise Report for the Proposed 101 HOV Gap Closure Project have failed to adequately identify, calculate and mitigate existing and future traffic noise impacts caused by noise reflections and multiple reflections as a result of the "special situations" and ficertain configurations" of the parallel noise barriers.



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SUMMARY

The DEIS/R for the 101 HOV Gap Closure Project fails to adequately illustrate or identify fully the existing and future environmental impacts. It is a summary and, as such, it summarizes any potential noise problems out of existence.

One must study the technical reports to get any understanding of the potential environmental impacts. Even then, the conclusions drawn do not appear to be objective and are biased in favor of the project even if it is likely to do the community harm.

The DEIS/R and the Noise Impact Report almost totally ignore the question of reflected noise or multiple reflections due to parallel noise barriers. The noise report admits that there is a debate *in regards to the "magnitude of the problem." However, the report errs by downplaying or ignoring existing and future noise impacts rather than exploring and identifying the "worst case scenario" for each alternative --- including the no-build alternative.

The Noise Report, *in an apparent attempt to downplay the noise impacts, even references the Caltrans' "405 Study" which specifically states that "Due to the complex geometry of the project site, the results of this study should be considerd specific to this site only. They should not be applied to other parallel sites." The Noise Report would be a stronger document without this reference.

The Noise Report does identify from the Caltrans' "Route 99 Study" that there should be minimum 10: 1 ratio between the height and distance of the noise barriers (12 foot wall= 120 between walls) or there may be a perceptible reduction in performance.

The Noise Report fails to mention that large sections of the existing noise barriers in San Rafael are at a 8:1 ratio; it also fails to calculate the existing or future noise impacts for the homes on the hillside due to reflections and/or multiple reflections.

The DEIS/R and the Noise Report also choose to ignore any noise impacts from noise barriers that are less than the 10: 1 ratio in the " southbound alternative," including on and off ramps, rather than actually calculate the

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impacts and consider mitigation. For the sound wall over "Linden Lane," the Noise report identifies that it will be at a 9.5 : I ratio to the parallel wall. However, the report finds that since the wall is "rather short" (they find a. 300 foot wall "rather short") and "its W/H ratio close to the acceptable ratio, no special barrier treatment will be required at this location." This ignores the FHWA guidelines which recommend that "Action required to minimize degradation" for walls at a less than (W/H) 10: 1 ratio.

A absorptive section of wall would mitigate this potential problem. The Noise Report and the FEIS/R need to identify current prices for alternative wall materials --- including absorptive walls.

The "99 Study" also mentions under "RECOMMENDATIONS" that: "Construction of a noise barrier between source and receiver tended to enhance wind effects." If noise barriers do enhance wind effects this should be discussed and impacts identified in the FEIS/R for this project under the various alternatives.

Caltrans told the City and residents back 'in the 1980's that the concept of reflected noise cannot be verified via calculations that would show the increase in noise sufficient to be perceptible. This was not true then --- it is not true now. Caltrans has now discovered that sound walls can reflect noise under certain conditions or special configurations --- conditions and configurations that the San Rafael noise barriers actually exceed in potential for reflected noise problems.

I'm afraid that if Caltrans continues to ignore reflected noise and multiple reflections they are risking litigation and their own credibility which could ultimately delay the project.

Please calculate the reflected noise problem. Please apologize to the homeowners on the hillside --- tell them that maybe they weren't wrong --- the freeway noise may have increased substantially for them due to the parallel barriers. Please identify the problems with every available means --- then mitigate them and let us move forward.

Let's get this show on the road.

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RECOMMENDATIONS

Caltrans should hire accoustic specialists to perform long term noise studies to determine (1) the noise impacts as a result of reflections and multiple reflections caused by the parallel noise barriers and (2) what effect wind will play in connection with the noise barriers under all the different alternatives.

Since it is difficult to isolate reflections and multiple reflections from atmospheric conditions, Caltrans or appropriate specialists should also follow both state and Federal guidelines to calculate and model the "worst case scenario" for the parallel barriers for all the alternatives --- including the "no-build" alternative.

Caltrans or appropriate specialists should calculate the noise impacts due to possible reflections and multiple reflections for the noise barrier over "Linden Lane" (under the southbound alternative) and provide mitigation.

When there is even the slightist concern in regards to possible reflected noise or multiple reflections, absorptive walls should be considered. It is far cheaper to install absorptive walls during construction than to retrofit reflective walls with absorptive material after completion of the project.

Caltrans should work with the Citizen's Advisory Group and other appropriate groups or committees to determine visual impacts and the best way to mitigate them.

Caltrans should provide extensive landscaping on both sides of new noise barriers to deter graffiti and help mitigate the visual impacts the walls have on the surrounding environment.

Old noise barriers need to be retro-fitted with landscaping so there is a visual continuity through the city; and to ensure that the city viewscape is consistent as one views the city from the highway. The retro-fitted landscaping would also deter graffiti.

Drilling holes in the walls and trying to train ivy to grow up the freeway side of the walls has proven to be not effective here in Marin. Caltrans should consider all alternatives for planting on both sides of the walls.

"Green Walls" or "Living Walls" should be considered whenever possible.

Berming should be fully explored and used whenever possible, even if it means taking a few extra feet of r/w. Berming on even one side would help mitigate potential visual impacts. Landscaping and berming is ideal.

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NOISE BARRIER FACT SHEET

Attenuation of highway traffic noise can be achieved only when the line of sight between the source and the observer is interrupted.

Wind effects can significantly increase noise levels downwind of the source by as much as 10 dBA.

Construction of a noise barrier between source and receiver tend to enhance wind effects.

Walls should be at a distance of at least (W/H) 10: 1 ratio to prevent multiple reflections and to avoid the risk of perceptible reduction in performance.

Parallel barriers can 'increase reflected noise levels by more than 6 dBA due to multiple reflections.

Wind effects and multiple reflections can combine to increase noise levels by 9 dBA or more. (The human ear perceives a 10 dBA 'increase to be twice as loud).

it is recommended that noise barriers be at a ratio of (W/H) 15: 1.

Noise barriers can change the frequency of the highway noise.

Atmospheric conditions (such as temperture or inversion layers) may bend or refract highway noise into neighborhoods behind the walls.

Noise barriers on berms reflect less noise (as much as 3 dBA less).

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Sound is transmitted through the air by sound pressure waves which are produced by the noise source. When the waves hit a barrier a fluctuatin5 pressure is applied to the face of the barrier. (Figure No. 10). The fluctuating pressure is much like a wave of water moving toward a flat wall, the wave moves toward the wall with an amplitude of X when it strikes the wall the waves amplitude doubles and becomes 2X. Thus, the sound pressure doubles as it hits the barrier. This doubling of sound pressure represents a 6dB increase in the sound which can be

shown as follows:

$$P_1 = 100 \text{dyn/cm}^2 \text{ then } SPL_1 = 20 \log \frac{P_1}{P_0} = 20 \log \frac{100 \text{ dyn/cm}^2}{.0002 \text{ dyn/cm}^2} = 114$$

$$P_2 = 200 \text{dyn/cm}^2 \text{ then } SPL_2 = 20 \log \frac{P_1}{P_o} = 20 \log \frac{200 \text{ dyn/cm}^2}{.0002 \text{ dyn/cm}^2} = 120$$

$$\text{and } SPL_2 - SPL_1 = 120 - 114 = 6 \text{ dB}$$

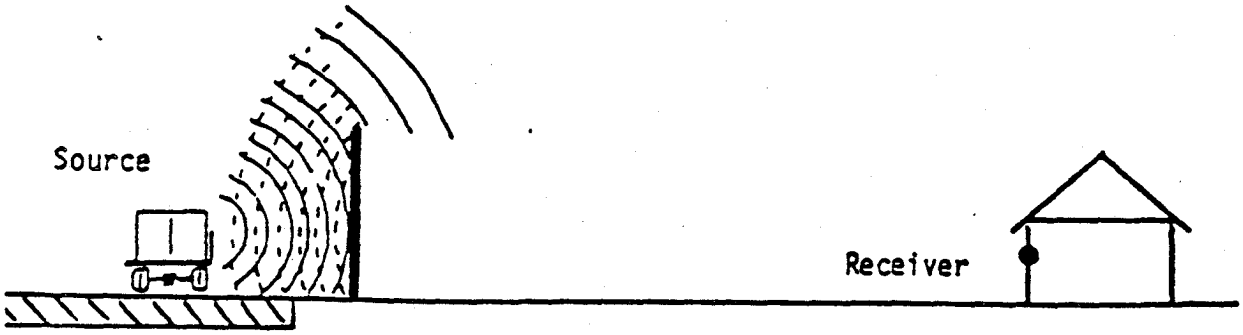


FIGURE 10

Example #6

In Example #6, the concept of noise reflection is introduced. The roadway is depressed with reflecting retaining walls on both sides as shown in Sketch 5.18.

The traffic has been condensed into only two lanes to simplify the discussion, although it should not be condensed before testing with the nomograph. The reflection from the retaining wall is incorporated by adding the mirror images of the traffic in the wall, as shown in the figure. Again, the barrier is assumed to subtend an angle of 180 degrees at the receiver. The full line-of-sight (L/S) distance is used in the nomograph - the distance from traffic to reflecting wall to receiver. The corresponding worksheet is included as Sketch 5.19.

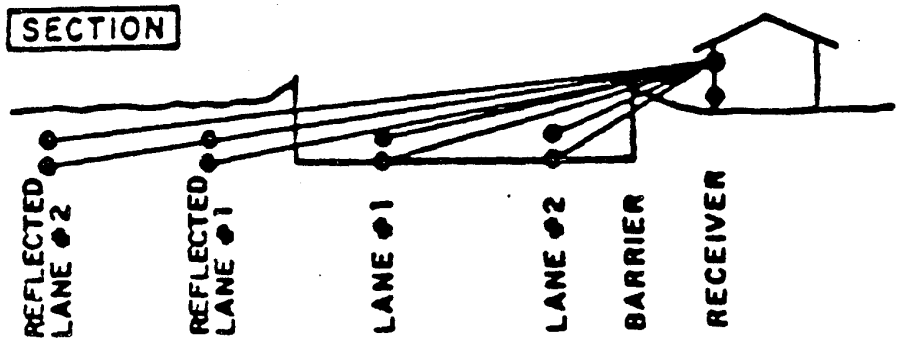
Notice that the reflected noise dominates the L_{10}. Without reflection, the noise level at the receiver would be 82.0 dBA, a significant underestimate of the impact.

It is also possible that noise due to multiple reflections is significant. For example, if the reflected noise in the example had been attenuated by the barrier (higher barrier), then perhaps some multiply reflected noise - reflected first from the right, then from the left, then over the barrier - would not be attenuated by the barrier and might control the noise at the receiver.

NOISE SOURCE	NO BARRIER L_{10}	L_{10} BARR. ATTEN.	WITH BARRIER L_{10}
LANE 2 Trucks	82.5	0	82.5
REFLECTED Autos	—		—
SAME Autos	77.5	0	77.5
	=83.5		=83.5
LANE 1 Trucks	84.0	0	84.0
REFLECTED Autos	=87.0		=87.0
SAME Autos	79.0	5.5	73.5
	=87.5		=87.0
LANE 1 Trucks	86.0	6.0	80.0
	=90.0		=88.0
SAME Autos	81.0	8.5	72.5
	=90.5		=88.0
LANE 2 Trucks	88.5	13.0	75.5
	=92.5		=88.5
SAME Autos	83.5	16.0	67.5
	=92.0		=88.5
Trucks			
Autos			
Trucks			
Autos			
TOTAL	93.0	TOTAL	88.5

NET BARRIER ATTENUATION: 4.5 dBA for L_{10}

SKETCH 5.19



SKETCH 5.18

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